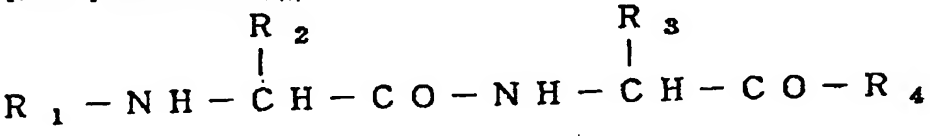
* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

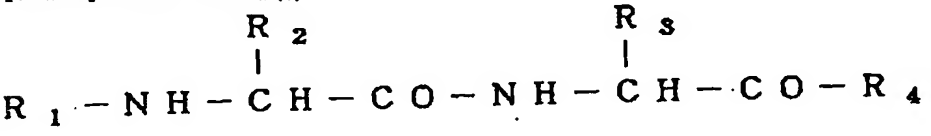
CLAIMS

[Claim(s)]
[Claim 1] General formula (1)



(1)

R1 expresses a benzyloxycarbonyl radical or 4-phenyl butyryl radical among [type, R2 expresses an isopropyl group or an isobutyl radical, R3 expresses butyl, benzyl, or a methylthio ethyl group, and R4 expresses a hydrogen atom or a chloro methyl group. The compound expressed with].
[Claim 2] General formula (1)



(1)

R1 expresses a benzyloxycarbonyl radical or 4-phenyl butyryl radical among [type, R2 expresses an isopropyl group or an isobutyl radical, R3 expresses butyl, benzyl, or a methylthio ethyl group, and R4 expresses a hydrogen atom or a chloro methyl group. Cysteine proteinase inhibitor which contains the compound expressed with] as an active principle.

[Translation done.]

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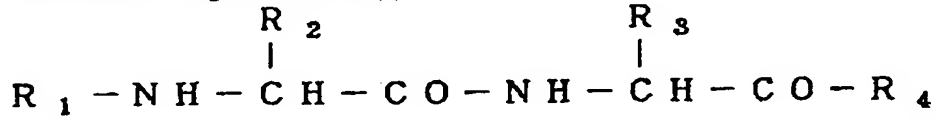
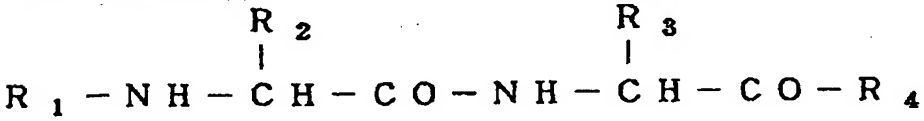
DETAILED DESCRIPTION

[Detailed Description of the Invention]
(Field of the Invention)
This invention is a general formula (1).



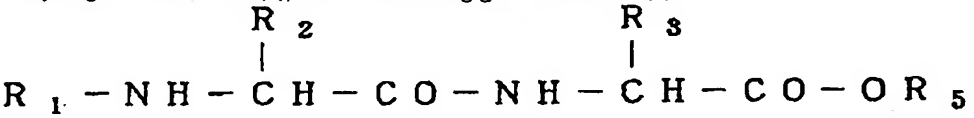
(1)

R1 expresses a benzyloxycarbonyl radical or 4-phenyl butyryl radical among [type, R2 expresses an isopropyl group or an isobutyl radical, R3 expresses butyl, benzyl, or a methylthio ethyl group, and R4 expresses a hydrogen atom or a chloro methyl group. It is the compound expressed with] and is related with the cysteine proteinase inhibitor in which strong oxygen inhibition activity is shown to cysteine proteinase especially a papain, and calpain.
(Prior art)
It is known that the drugs which check specifically the activity of the papain (E. C.3.4.22.2, PAPAIN) which is a kind of cysteine proteinase, and calpain (E. C.3.4.22.17, CALPAIN) are effective as remedies, such as myotrophia dystonica or a cataract, about calpain especially as an anti-inflammatory agent. Although cysteine proteinase inhibitor various until now has been found out aiming at development of these applications, the present condition is that an improvement in fields, such as (Shimizu, B. et al., J.Antibio/t., 25 volumes, 515 pages, (1972), JP,60-28990,A, JP,61-106600,A and JP,61-103897,A), activity, singularity, and living body internal transmigration nature, is desired strongly.
(Trouble which invention tends to solve)
Then, especially this invention persons completed this invention variously as a result of a synthetic examination so that the inhibition activity over calpain may be strong and may find out a compound with still higher living body internal transmigration nature also in cysteine proteinase.
(Means for solving a trouble)
The general formula which will be the new molecular entity which has powerful calpain inhibition or papain inhibition activity if this invention is followed (1)



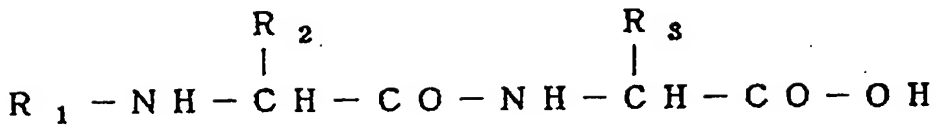
(1)

R1 expresses a benzyloxycarbonyl radical or 4-phenyl butyryl radical among [type, R2 expresses an isopropyl group or an isobutyl radical, R3 expresses butyl, benzyl, or a methylthio ethyl group, and R4 expresses a hydrogen atom or a chloro methyl group. The N-acyl-peptidyl-aldehyde expressed with] or an N-acyl-peptidyl-chloro methyl ketone is supplied.
The compound of this invention can be manufactured as follows. First, in order to manufacture the compound of this invention whose R4 is hydrogen in a formula (1), it is the following general formula (2).



(2)

R1, R2, and R3 express among [type the semantics given by said formula (1), and R5 expresses a low-grade alkyl group. The compound expressed with] is returned even to the alcoholic body using the reducing agent in an organic solvent, and it is easily manufactured by oxidizing to an aldehyde using an oxidizing agent further. Moreover, in order to manufacture the compound of this invention whose R4 is a chloro methyl group in a general formula (1), it is the following general formula (3).



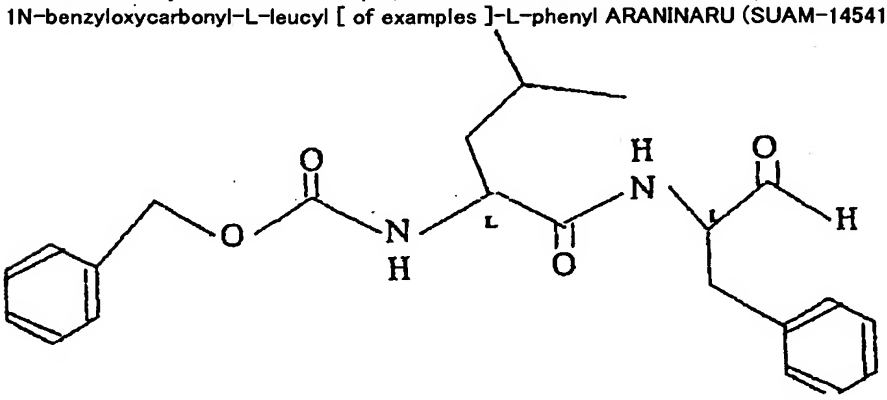
(3)

R1, R2, and R3 express among {type the semantics given by said formula (1). It is easily manufactured by leading the carboxylic acid expressed with} to activity ester using the chloro ethyl carbonate in an organic solvent etc., making diazomethane react, considering as a diazo methyl ketone, and carrying out hydrochloric-acid processing further.

(Example)

Next, although an example and an inhibition activity trial explain this invention still more concretely, it cannot be overemphasized that it is not what limits the technical range of this invention according to these examples. Since a compound is specified in an oxygen inhibition activity trial and an example, a SUAM number is used, and it explains below.

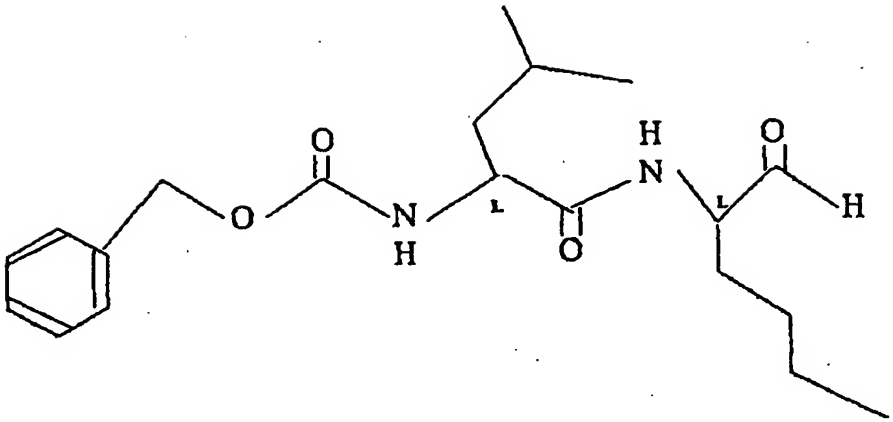
1N-benzyloxycarbonyl-L-leucyl [of examples]-L-phenyl ARANINARU (SUAM-14541)



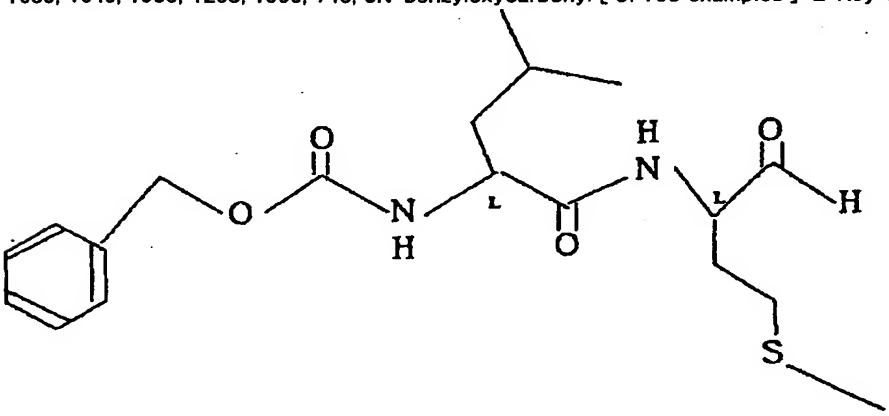
An L-phenylalanine ethyl ester hydrochloride (4.6g, 20mmol) and N-benzyloxycarbonyl-L-leucine (5.4g, 20mmol) were dissolved in 100m [of desiccation methylene chlorides] **, and triethylamine (2.0g, 20mmol) was added. The 1-ethyl-3-(3-dimethylaminopropyl) carbodiimide hydrochloride (WSCD) (4.2g, 22mmol) was added to this solution, and it stirred at the room temperature one whole day and night. The reaction mixture after reaction termination was washed in order of 1-N hydrochloric acid, saturation brine, saturation aerated water acid sodium, and saturation brine, and it dried on anhydrous sodium sulfate.

When the solvent was distilled out and the medium-voltage column chromatography using silica gel refined residue, N-benzyloxycarbonyl-L-leucyl-L-phenylalanine ethyl ester (8.4g, crystal) was obtained. This N-benzyloxycarbonyl-L-leucyl-L-phenylalanine ethyl ester (2.2g, 5mmol) and sodium borohydride (570mg, 15mmol) were suspended in tertiary butyl alcohol (50m**), and heating reflux (90 degrees C) was carried out to the bottom of nitrogen-gas-atmosphere mind. Subsequently, the bottom of reflux anhydrous methanol (8m**) was dropped. After carrying out reflux stirring for after [dropping termination] 1 hour, it returned to the room temperature, and water was added to the bottom of ice-cooling (30m**). After carrying out reduced pressure distilling out of a methanol and the tertiary butyl alcohol, ethyl acetate extracted 3 times and it dried on after [washing] sulfuric anhydride magnesium with saturation brine. When the medium-voltage column chromatography using silica gel refined the residue obtained by carrying out reduced pressure distilling out of the ethyl acetate, N-benzyloxycarbonyl-L-leucyl-L-phenyl ARANI Norian (1.5g, crystal) was obtained. This N-benzyloxycarbonyl-L-leucyl-L-phenyl ARANI Norian (1.2g, 3mmol) and triethylamine (1.2g, 12mmol) were dissolved in anhydrous dimethyl sulfoxide (8m**), and the dimethyl sulfoxide (8m**) solution of a sulfur-trioxide-pyridine complex (1.9g, 12mmol) was added to the bottom of stirring. It flowed into the iced water after stirring (120m**) for 10 minutes at the room temperature, ethyl acetate extracted 3 times, and it washed in order of 10% citric-acid water solution, saturation brine, a saturation sodium-hydrogencarbonate solution, and saturation brine, and dried on anhydrous sodium sulfate. When the medium-voltage column chromatography using silica gel refined the residue obtained by carrying out reduced pressure distilling out of the ethyl acetate, purpose compound N-benzyloxycarbonyl-L-leucyl-L-phenyl ARANINARU (0.6g, oily matter) was obtained.

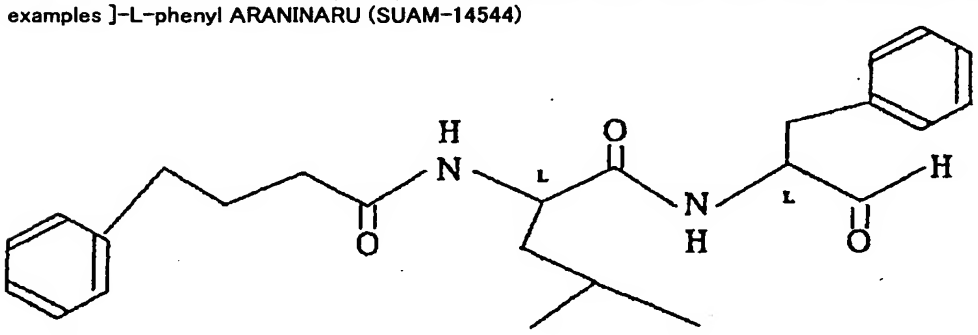
Inside of 1 H-NMR;CDCl3, TMS criteria 0.80-1.00 (6H, m), 3.12 (2H, m) 1.22-1.72 (3H, m), 4.16 (1H, m), 4.66 (1H, m), 5.08 (2H, s), 5.12 (1H, m), A measurement configuration 5.64 (1H, m), 7.16-7.34 (10H, m), 9.56 (1H, s) IR spectra; A film, Wave number (cm-1); 3330, 3270, 3030, 2960, 1730, 1680, 1650, 1530, 1240, 1040, 750, 740, 2N-benzyloxycarbonyl-L-leucyl [of 700 examples]-L-NORUROI Cynal (SUAM-14542)



In the example 1, purpose compound N-benzyloxycarbonyl-L-leucyl-L-NORUROI Cynal (0.5g, powder object) was obtained by using L-norleucine methyl ester hydrochloride (3.6g, 20mmol) instead of an L-phenylalanine ethyl ester hydrochloride. Melting point; inside of 93-degree-C1 H-NMR;CDCI3, TMS criteria 0.80-1.00 (9H, m), 1.22-1.28 (9H, m), 4.12-4.58 (2H, m), 5.12 (2H, s), 5.22 (1H, d, J= 8.0), 6.57 (1H, d, J= 7.0), A measurement configuration 7.36 (5H, s), 9.54 (1H, s) IR spectra; KBr, Wave number (cm-1); 3320, 3030, 2950, 1720, 1680, 1640, 1530, 1230, 1050, 740, 3N-benzyloxycarbonyl [of 700 examples]-L-Roy Carew L-MECHIONINARU (SUAM-14543)

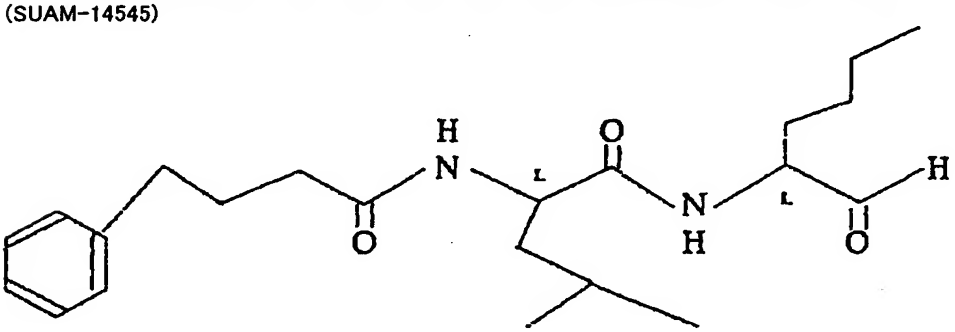


In the example 1, purpose compound N-benzyloxycarbonyl-L-leucyl-L-MECHIONINARU (0.5g, oily matter) was obtained by using a L-methionine methyl ester hydrochloride (4.0g, 20mmol) instead of an L-phenylalanine ethyl ester hydrochloride. Refractive index; (a D line, 25 degrees C) inside of;1.53421 H-NMR;DMSO-d6, TMS criteria 0.94 (6H, d, J= 6.0), 1.42- 2.58 (5H, m), 2.06 (3H, s), and 4.08-4.62 (2H, m) — 5.10 (2H, s), 5.37 (1H, d, J= 7.0), 6.95 (1H, d, J= 6.0), A measurement configuration 7.34 (5H, s), 9.56 (1H, d, J= 2.0) IR spectra; A film, Wave number (cm-1); 3300, 3070, 2950, 1720, 1700, 1660, 1530, 1240, 1040, 740, 4N-(4-phenyl) butanoyl-L-leucyl [of 700 examples]-L-phenyl ARANINARU (SUAM-14544)

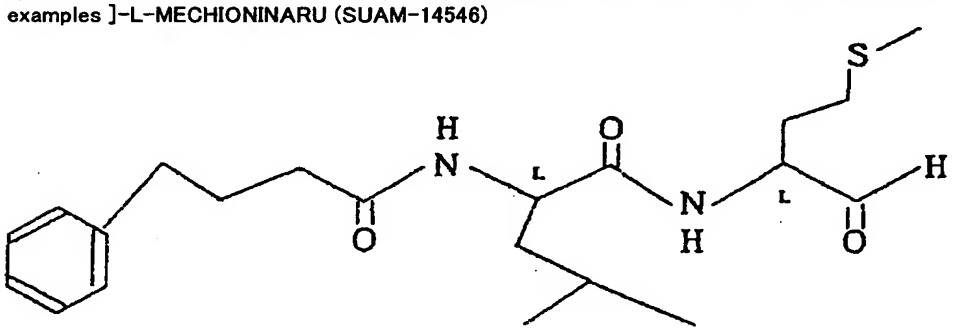


The N-benzyloxycarbonyl-L-leucyl-L-phenylalanine ethyl ester (2.2g, 5mmol) which is the synthetic intermediate product of an example 1 was dissolved in ethyl alcohol (50m**), a small amount of palladium carbon was added, and it stirred at the room temperature under the hydrogen ambient atmosphere for 24 hours. The palladium carbon after reaction termination was filtered and reduced pressure distilling out of the ethyl alcohol was carried out. This residue was dissolved in tetrahydrofuran 50m**, and triethyl ulmin (1.0g, 10mmol) was added. The bottom (4-phenyl) butanoyl chloride of ice-cooling (0.9g, 5mmol) was dropped at this solution, and it stirred for 1 hour. It returned to the room temperature after that, and stirred for further 1 hour. Reduced pressure distilling out of the tetrahydrofuran after reaction termination was carried out, and residue was dissolved in the ethyl acetate of 50m**. This solution was washed in order of 1-N hydrochloric acid, saturation brine, a saturation sodium hydrogencarbonate, and saturation brine, and it dried on anhydrous sodium sulfate. When the medium-voltage column chromatography using silica gel refined the residue obtained by carrying out reduced pressure distilling out of the solvent, N-(4-phenyl) butanoyl-L-leucyl-L-phenylalanine ethyl ester (2.0g, crystal) was obtained. This N-(4-phenyl) butanoyl-L-leucyl-L-phenylalanine ethyl ester (1.4g, 3mmol) and hydroxylation boron sodium (340mg, 9mmol) were suspended in tertiary butyl alcohol (30m**), and heating reflux (90 degrees C) was carried out to the bottom of nitrogen-gas-atmosphere mind. Subsequently, the bottom of reflux anhydrous methanol (5m**) was dropped. After carrying out reflux stirring for after [dropping termination] 1 hour, it returned to the room temperature, and water was added to the bottom of ice-cooling (30m**). After carrying out reduced pressure

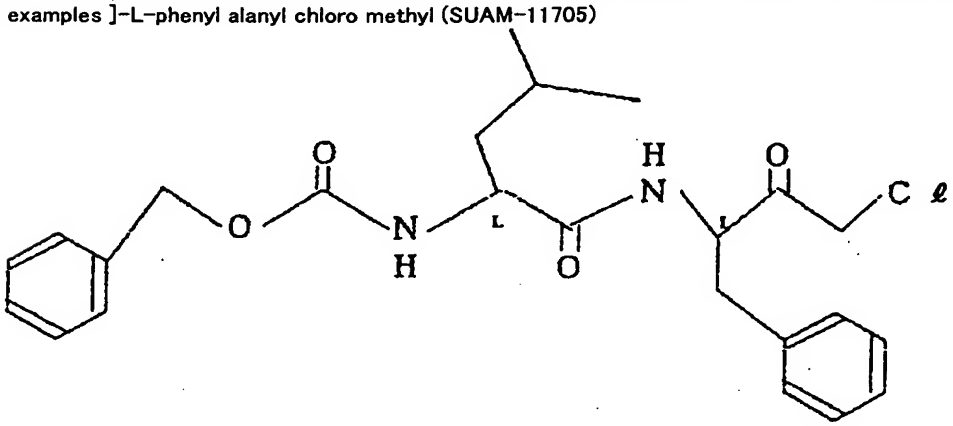
distilling out of a methanol and the tertiary butyl alcohol, ethyl acetate extracted 3 times and it dried on after [washing] sulfuric anhydride magnesium with saturation brine. When the medium-voltage column chromatography using silica gel refined the residue obtained by carrying out reduced pressure distilling out of the ethyl acetate, N-(4-phenyl) butanoyl-L-leucyl-L-phenyl ARANI Norian (1.2g, crystal) was obtained. This N-(4-phenyl) butanoyl-L-leucyl-L-phenyl ARANI Norian (1.1g, 2.5mmol) and triethylamine (1.0g, 10mmol) were dissolved in anhydrous dimethyl sulfoxide (8m**), and the dimethyl sulfoxide (8m**) solution of a sulfur-trioxide-pyridine complex (1.6g, 10mmol) was added to the bottom of stirring. It flowed into the iced water after stirring (120m**) for 10 minutes at the room temperature, ethyl acetate extracted 3 times, and it washed in order of 10% citric-acid water solution, saturation brine, a saturation sodium-hydrogencarbonate solution, and saturation brine, and dried on anhydrous sodium sulfate. When the medium-voltage column chromatography using silica gel refined the residue obtained by carrying out reduced pressure distilling out of the ethyl acetate, purpose compound N-(4-phenyl) butanoyl-L-leucyl-L-phenyl ARANINARU (0.6g, oily matter) was obtained.
Inside of 1 H-NMR;CDCl3, TMS criteria 0.80-1.00 (6H, m), 1.52-2.26 (7H, m), 2.52-2.72 (2H, m), 3.12 (2H, m) and 4.40- 4.76 (2H, m) and 5.72 (1H, d, J= 7.0) — 6.68 (1H, d, J= 6.0) 7.14-7.26 (10H, m), A measurement configuration 9.58 (1H, s) IR spectra; A film, Wave number (cm-1); 3720, 3060, 2950, 1730, 1630, 1540, 1240, 740, 5N-(4-phenyl) butanoyl-L-leucyl [of 700 examples]-L-NORUROI Cynal (SUAM-14545)



In the example 4, purpose compound N-(4-phenyl) butanoyl-L-leucyl-L-NORUROI Cynal (0.6g, oily matter) was obtained by using the N-benzyloxycarbonyl-L-leucyl-L-norleucine methyl ester (5.3g, 12mmol) which is the synthetic intermediate product of an example 3 instead of the synthetic intermediate-product N-benzyloxycarbonyl-L-leucyl-L-phenylalanine ethyl ester of an example 1.
Refractive index (a D line, 25 degrees C); inside of 1.51231 H-NMR;CDCl3, The TMS criteria 0.80-1.00 (6H, m), 1.24-2.32 (13H, m), 2.57-2.72 (2H, m), 4.30-4.63 (2H, m), 6.02 (1H, d, J= 8.0) 6.28 (1H, d, J= 7.0), A measurement configuration 7.18-7.23 (5H, m), 9.54 (1H, s) IR spectra; A film, Wave number (cm-1); 3270, 3060, 2950, 1730, 1630, 1540, 1240, 740, 6N-(4-phenyl) butanoyl-L-leucyl [of 700 examples]-L-MECHIONINARU (SUAM-14546)

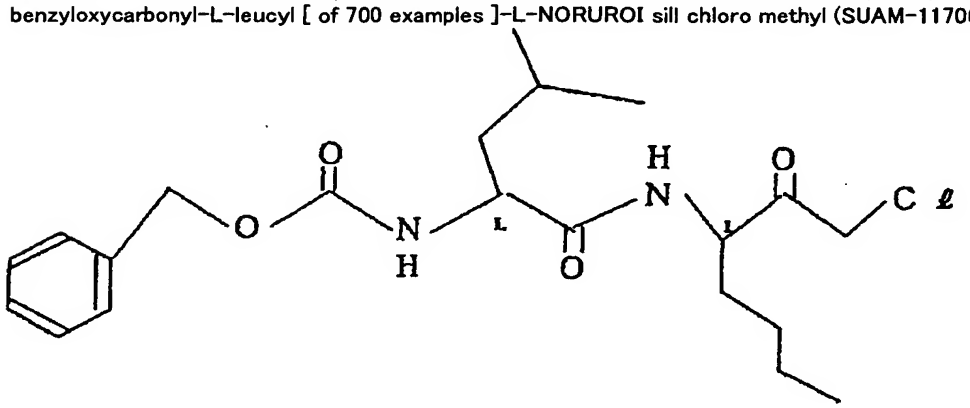


In the example 4, purpose compound N-(4-phenyl) butanoyl-L-leucyl-L-MECHIONINARU (0.5g, oily matter) was obtained by using the N-benzyloxycarbonyl-L-leucyl-L-methionine methyl ester (2.1g, 5mmol) which is the synthetic intermediate product of an example 2 instead of the synthetic intermediate-product N-benzyloxycarbonyl-L-leucyl-L-phenylalanine ethyl ester of an example 1.
Refractive index (a D line, 25 degrees C); inside of 1.53271 H-NMR;CDCl3, The TMS criteria 0.80-1.00 (6H, m), 1.40-2.80 (11H, m), 2.03-2.06 (total-3H, both-s), 4.39-4.60 (2H, m), 6.02 (1H, d, J= 8.0) 7.18-7.22 (6H, m), A measurement configuration 9.55, 9.58 (total-1H, both-s), an IR spectrum; A film, Wave number (cm-1); 3270, 3060, 2950, 1730, 1630, 1540, 1240, 740, 7N-benzyloxycarbonyl-L-leucyl [of 700 examples]-L-phenyl alanyl chloro methyl (SUAM-11705)

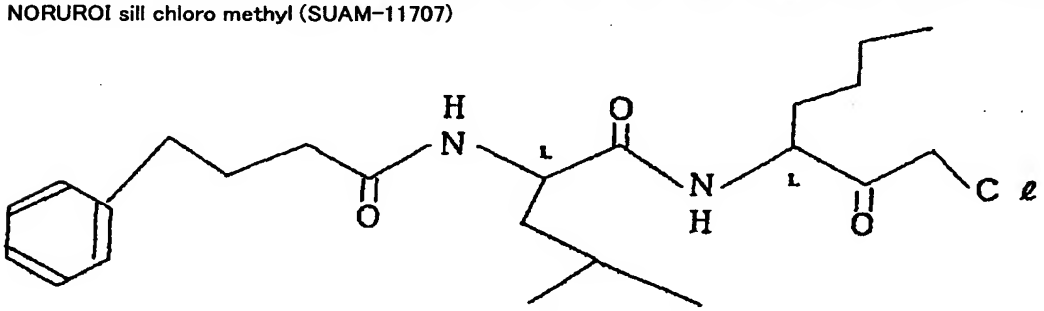


10m** The N-benzyloxycarbonyl-L-leucyl-L-phenylalanine ethyl ester (2.6g, 6mmol) which is the synthetic intermediate product of an

example 1 was dissolved in a small amount of methyl alcohol, and 1-N sodium-hydroxide water solution was added. This suspension was stirred at the room temperature until it became a transparent solution. Reduced pressure distilling out of the methyl alcohol was carried out, and it distributed to water and ethyl acetate. The water layer was made into acidity with 10-N hydrochloric acid, and the extract and the organic layer were dried on anhydrous sodium sulfate 3 times with ethyl acetate. When reduced pressure distilling out of the solvent was carried out, N-benzyloxycarbonyl-L-leucyl-L-phenylalanine (2.4g, crystal) was obtained. This N-benzyloxycarbonyl-L-leucyl-L-phenylalanine (2.1g, 5mmol) was dissolved in the desiccation tetrahydrofuran (20m**), triethylamine (0.5g, 5mmol) was added, and it cooled at -10 degrees C. Chloro ethyl carbonate (0.6g, 5mmol) was added to this solution, and it stirred for 20 minutes at -10 degrees C. It returned to the room temperature, the ether solution of superfluous diazomethane was added, and it stirred for 30 more minutes. Hydrochloric acid gas was blown into this reaction mixture for about 10 minutes. The solvent after reaction termination was distilled out, ethyl acetate (50m**) was added, and it washed in order of saturation brine, a saturation sodium-hydrogencarbonate solution, and saturation brine, and dried on anhydrous sodium sulfate. When the medium-voltage column chromatography using silica gel refined the residue obtained by carrying out reduced pressure distilling out of the solvent, purpose compound N-(4-phenyl) butanoyl-L-leucyl-L-phenyl alanyl chloro methyl (1.5g, crystal) was obtained.
Melting point; inside of 140-degree-C1 H-NMR;DMSO-d6, TMS criteria 0.80 (6H, dd, J= 4.0, J= 7.0), 1.00-1.70 (3H, m), 2.70-3.40 (2H, m), 3.95 (1H, m) 4.45 (2H, dd, J= 5.0, J= 16.0), 4.50 (1H, m) 5.00 (2H, S) 7.21 (5H, s), A measurement configuration 7.28 (5H, s), 7.41 (1H, d, J= 8.0), 8.42 (1H, d, J= 8.0) IR spectra; KBr, Wave number (cm-1); 3310, 3280, 2950, 1730, 1685, 1540, 1265, 1240, 8N-benzyloxycarbonyl-L-leucyl [of 700 examples]-L-NORUROI sill chloro methyl (SUAM-11706)



In the example 7, purpose compound N-(4-phenyl) butanoyl-L-leucyl-L-NORUROI sill chloro methyl (1.6g, crystal) was obtained by using the N-benzyloxycarbonyl-L-leucyl-L-norleucine methyl ester (2.4g, 6mmol) which is the synthetic intermediate product of an example 2 instead of the synthetic intermediate-product N-benzyloxycarbonyl-L-leucyl-L-phenylalanine ethyl ester of an example 1.
Melting point; inside of 111-degree-C1 H-NMR;DMSO-d6, TMS criteria 0.80-1.00 (9H, m), 4.04 (1H, m) 1.00-1.90 (9H, m), 4.30 (1H, m), 4.54 (2H, s), 5.00 (2H, S), 7.36 (5H, s), A measurement configuration 7.46 (1H, d, J= 8.0), 8.36 (1H, d, J= 8.0) IR spectra; KBr, Wave number (cm-1); 3300, 2950, 1740, 1680, 1660, 1640, 1530, 1280, 1240, 9N-(4-phenyl) butanoyl-L-leucyl [of 690 examples]-L-NORUROI sill chloro methyl (SUAM-11707)



In the example 7, purpose compound N-(4-phenyl) butanoyl-L-leucyl-L-NORUROI sill chloro methyl (1.0g, crystal) was obtained by using the N-(4-phenyl) butanoyl-L-leucyl-L-norleucine methyl ester (2.4g, 6mmol) which is the synthetic intermediate product of an example 6 instead of the synthetic intermediate-product N-benzyloxycarbonyl-L-leucyl-L-phenylalanine ethyl ester of an example 1.
Melting point; inside of 114-degree-C1 H-NMR;DMSO-d6, TMS criteria 0.80-1.00 (9H, m), 4.30 (2H, m) 1.00-2.40 (15H, m), 4.52 (2H, s), A measurement configuration 7.20 (2H, s), 8.00 (1H, d, J= 8.0), 8.32 (1H, d, J= 8.0) IR spectra; KBr, Wave number (cm-1); the oxygen inhibition activity of the oxygen inhibition activity this invention matter of 3300, 2950, 1730, 1630, 1530, and the example this invention matter of 690 trials was measured as follows.
Anti-papain activity pre incubated this invention compound prepared to various concentration, the papain (0.015unit), and the citrate-buffer-solution solution (20mM, pH=6.2, 1m**) of EGTA (0.88mg) for 5 minutes at 30 degrees C, added the substrate solution (1m**), and started the reaction. It was made to react for 20 minutes at 30 degrees C, using 1% citrate-buffer-solution solution of casein as a substrate. subsequently, the amount of protein in the trichloroacetic-acid meltable fraction of the casein which added 6.5 trichloroacetic acids (3m**) to reaction mixture, was made to suspend a reaction, and was hydrolyzed with the enzyme — Raleigh FORIN (Lowry-Folin) -- it measured by law and inhibition activity was searched for from the comparison with the contrast solution. About each of calpains I and II, anti-calpain activity pre incubated this invention compound, Calpain I, or the imidazole-hydrochloric-acid buffer-solution solution (50mM, pH=7.5, 1m**) of II (0.33unit) and CaCl2 (0.22mg) prepared to various concentration for 5 minutes at 30 degrees C, added the substrate solution (1m**), and started the reaction. It was made to react for 30 minutes at 30 degrees C, using 0.4% imidazole hydrochloric-acid buffer-solution solution of casein as a substrate. subsequently, the amount of protein in the trichloroacetic-acid meltable fraction of the casein which added the trichloroacetic acid (3m**) to reaction mixture 5%, was made to suspend a reaction, and was hydrolyzed with the enzyme — loss SHATTSU (Roos-Schatz) -- it measured by law and inhibition activity was searched for from the comparison with the contrast solution.

Thus, the activity inhibitory action to the papain of the obtained this invention compound and Calpains I and II is shown in Tables I, II, and III.

表Ⅰ　パパインに対する阻害活性

SUAM番号	ID50(μg/tube)
14544	0.015
14545	0.011
14546	0.015
11706	0.010
11707	0.021
ロイペプチン	0.045

表Ⅱ　カルパインⅠに対する阻害活性

SUAM番号	ID50(μg/tube)
14541	0.080
14542	0.038
14545	0.030
14546	0.030
11706	0.12
11707	0.060
ロイペプチン	0.18

表Ⅲ　カルパインⅡに対する阻害活性

SUAM番号	ID50(μg/tube)
14541	0.028
14542	0.025
14543	0.019
14544	0.024
14545	0.24
14546	0.056
11706	0.095
11707	0.12
ロイペプチン	0.80

(Effect of the invention)
Since the composition is also easy, the new molecular entity of this invention not only has the inhibition activity which was very excellent to cysteine proteinases, such as a papain, Calpain I, and Calpain II, but can expect the application as an anti-inflammatory agent, myotrophia dystonica, or a cataract remedy.

[Translation done.]

⑲日本国特許庁(JP)　⑪特許出願公開

⑫公開特許公報(A)　昭62－9229

⑤1Int.Cl.⁴　識別記号　庁内整理番号　⑬公開　昭和62年(1987)1月17日
G 01 J 1/02　K－7145－2G

審査請求　未請求　発明の数 1　(全4頁)

⑤4発明の名称　レーザパワーメータ

⑳特　願　昭60－147737
㉒出　願　昭60(1985)7月5日

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明　細　書

1．発明の名称　レーザパワーメータ

2．特許請求の範囲

(1)レーザ光が透過または反射する透光性又は光反射性の光学素子の周辺部に熱電対が設けられ、更にその外側に冷却器が設けられてセンサー部が構成されていることを特徴とするレーザパワーメータ。

(2)前記光学素子がレンズである特許請求の範囲第1項に記載のレーザパワーメータ。

(3)前記光学素子が反射鏡である特許請求の範囲第1項に記載のレーザパワーメータ。

3．発明の詳細な説明

(産業上の利用分野)

本発明はレーザパワーメータに関するものである。

(従来技術)

従来のレーザパワーメータは、第3図及び第4図に示すように、金属製の熱伝導性基板1の一方の面の中央に黒化吸収膜2が設けられ、該熱伝導性基板1の反対側の面には黒化吸収膜2の外側に位置するようにしてリング状に熱電対3が設けられ、更にその外側には冷却器4が設けられてセンサー部5が構成された構造になっていた。

このようなセンサー部5をもつレーザパワーメータは、測定すべきレーザ光が黒化吸収膜2に入射されると、熱エネルギーに変換され、その熱エネルギーは基板1の径方向に伝達され、冷却器4で冷却される。この際、基板1に配設されている熱電対3の温接点部の温度上昇はレーザ光のパワーに比例するので、これが増幅器で増幅されてレーザパワーとして表示される。

この時の熱伝導性基板1の温度分布を第5図に示す。第5図はレーザ光のパワー密度がガウシアンの場合であって、横軸は基板1上の位置(中心部0、冷却部R_1)、縦軸は温度を示す。図より、中心部0付近では急激に高温になっていることがわかる。中心部0付近の温度は、レーザパワーに

比例し、基板１の熱伝導率と厚さに反比例する。それ故、大出力の測定には熱伝導率が大きく、厚い基板１を使用しなければならない。

（発明が解決しようとする問題点）

しかしながら、熱伝導性基板１はその材料にも制限があり、厚さも無制限に大きくすることはできない問題点がある。また、ハイパワーを冷却器４で安定に冷却する際に、電気的出力に影響を与えないようにする点でも困難がある。更に、ハイパワーになると、黒化吸収膜２の厚さ方向でも温度差が大きくなり、黒化吸収膜２の表面温度は基板１の温度上昇よりも高温になり、黒化吸収膜２を損傷する危険がある。

本発明の目的は、冷却を容易にし、ハイパワーでも支障なく測定を行えるレーザパワーメータを提供することにある。

（問題点を解決するための手段）

上記の目的を達成するための本発明の構成を、実施例に対応する第１図及び第２図を参照して説明すると、本発明はレーザ光６が透過又は反射する透光性又は光反射性の光学素子７の周辺部に熱電対３が設けられ、更にその外側に冷却器４が設けられていることを特徴とするものである。

（作用）

このようなセンサー部５によれば、測定すべきレーザ光６は従来のセンサー部とは違って光学素子７を透過又は反射し、その一部が該光学素子７に吸収されて熱エネルギーとなり、該熱エネルギーは光学素子７を冷却器４の方向へ伝達され、その過程で熱電対３で検出される。

（実施例）

以下本発明の実施例を図面を参照して詳細に説明する。第１図は本発明の一実施例を示したものである。本実施例では、レーザ光６が透過する平板状の透光性光学素子７の周辺部に熱電対３が接着等により取り付けられて設けられ、更にその外側には冷却器４が設けられてセンサー部５が構成されている。熱電対３から出力されるレーザパワーに比例した電気信号は、増幅器８で増幅されて表示部９で表示されるようになっている。光学素子７を通過したレーザ光６は危険なので吸収器１０の黒化吸収膜１１で吸収され、冷却ジャケット１２で冷却されるようになっている。

このようなレーザパワーメータにおいては、測定すべきレーザ光６は光学素子７に直角に入射されて該光学素子７を透過し、その一部が光学素子７で吸収されて熱エネルギーになり、光学素子７の周辺部側に伝達され、冷却器４で冷却される。この伝熱の際に生ずる温度勾配を光学素子７の周辺部に配置されて熱電対３で検出すれば、光学素子７で吸収された熱エネルギーは透過したレーザパワーに比例し、温度勾配は熱流に比例するので、結局、熱電対３からは通過レーザパワーに比例した電気信号が取り出されることになる。この電気信号が増幅器８で増幅され、表示部９で表示される。光学素子７を通過したレーザ光６は、黒化吸収膜１１で吸収され、冷却ジャケット１２で冷却されるが、ここではパワー検出とは無関係なので、冷却ジャケット１２としては十分に厚い金属材料を使用することができ、自由に冷却することができる。

第２図は本発明の他の実施例を示したものである。本実施例は、レーザ加工機のレーザパワー測定に本発明を適用した例を示したものである。即ち、本実施例では、レーザ加工機の集束レンズをレーザパワーメータの光学素子７として兼用し、冷却器４はレーザ加工機の光学筒１３の先端に設けた例を示したものである。

このようにすると、レーザ加工作業中のレーザパワーの測定が同時に行えるようになる。

ただし、この場合、集束レンズが短焦点レンズの場合に、レーザビーム径が大きく変化すると誤差が大きくなるので、長焦点レンズか、測定用の平板状で透光性の光学素子を使って測定を行うことが好ましい。

また、レンズよりなる光学素子７を用いた場合

には、熱電対３はレンズに直接取り付けても、或いは第２図に示すようにレンズに他の材料７Ａを密着させて、その材料７Ａに取り付けてもよい。

上記実施例では、光学素子７として透光性の光学素子を用いた例について示したが、本発明はこれに限定されるものではなく、反射鏡を光学素子７として用い、その周辺部に熱電対３及び冷却器４を設けてセンサー部５を構成することもできる。

（発明の効果）

以上説明したように、本発明ではレーザ光が透過又は反射する透光性又は光反射性の光学素子の周辺部に熱電対及び冷却器を設けてセンサー部を構成したので、従来のセンサー部とは違って、ほとんどのレーザ光は該光学素子を通過又は反射するようになり、その一部が該光学素子に吸収されて熱エネルギーになり、この熱エネルギーは通過したレーザパワーに比例するので、熱電対で検出することによりレーザパワー測定を行うことができる。特に本発明のように、レーザ光を通過又は反射させるようにしてそのパワーの測定を行うようにすると、作業中にレーザパワーの測定も行えるようになり、また光学素子に吸収される熱エネルギーは僅かなのでその冷却も容易に行うことができ、且つハイパワーの測定でも容易に行える利点がある。

４．図面の簡単な説明

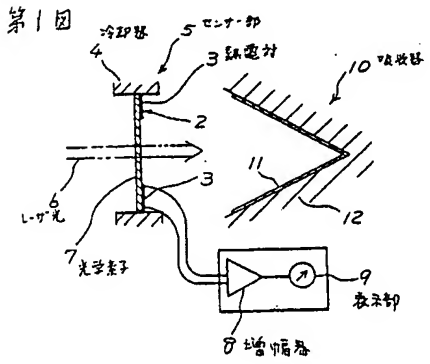
第１図は本発明に係るレーザパワーメータの一実施例の縦断面図、第２図は本発明の他の実施例の縦断面図、第３図及び第４図は従来のレーザパワーメータの縦断面図及び正面図、第５図は従来のセンサー部における熱伝導性基板の温度分布図である。

３…熱電対、４…冷却器、５…センサー部、６…レーザ光、７…光学素子、８…増幅器、９…表示部。

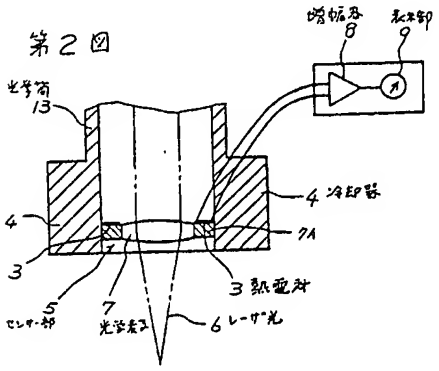
代理人　弁理士　松本英俊
（外１名）

図面の浄書(内容に変更なし)

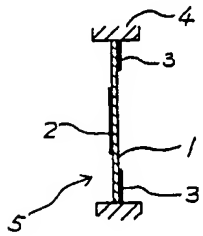
第１図



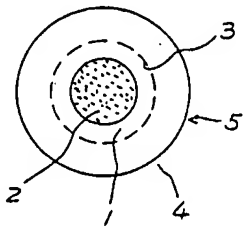
第２図



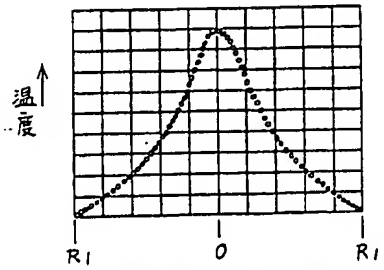
第３図



第４図



第５図



熱伝導性基板上の位置．

手続補正書（方式）

昭和６０年１１月　５日

特許庁長官　宇　賀　道　郎　殿

1．事件の表示

特願昭６０－１４７７３７号

2．発明の名称

レーザパワーメータ

3．補正をする者

事件との関係　特許出願人

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4．代　理　人

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（外１名）

5．補正命令の日付

昭和６０年１０月２９日

6．補正の対象

図面の第１図乃至第５図

7．補正の内容

別紙の通り

方式
審査

堤

60.11.5